Change of Inner City's Inhabitants and Its Implication in Urban Capital Cities in Japan

Change of Inner City's Inhabitants and Its Implication in Urban Residential Structure : A Comparative Study of Four Regional Capital Cities in Japan

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Abstract This paper reports the recent change of inhabitants in inner area of four regional capital cities in Japan, using thirty one attributes selected from "Mesh Statitics" of 1970 and 1985. After having divided the study areas into some concentric zones, each attributcte's change between 1970 and 1985 in the inner zone (Zone I) of every city was examined firstly. Secondly, having selected some attributes which showed remarkable change, their Location Quatients were computed in order to clarify the zonal differentiation and its change.

Followings are some of remakable findings ; ① increase in aged people and single person household, ② reduction of infants and blue-collar workers, ③ dispersion of commercial facilities, and ④ centralization of professional workers. These trends imply that the general image of inner area in Japan has changed from the place which is characterised by dense inhabitation of retailers, service workers, working women and family workers, to the place with professionals and managerial workers and more improved residential condition. These trends reflect the significant change in populational, industrial and family structure in recent urban society in Japan.

Key words: Sapporo, Sendai, Hiroshima, Fukuoka, mesh data, Location Quatient, inner city, residential structure

1. Background

Since Burgess has defined inner city area around CBD as "zone in tranzition" (Burgess 1925), residential condition of the area has been recognized as "blight" or "grey". This is because the area in big cities in industrialized society is the place where young and unstable people are densely living, and the land use is mixed with houses and industries, and many social pathological problems are taken place. In Japan, the situation is much the same (成田, 1976 ; Takayama, 1982 ; Tanaka, 1984 ; Kuwajima, 1985 ; Ishimaru, 1986). The inner area has also recognised as the place where people such as unskilled and low-paid workers, young families or students, who are easy to move, live in small and somewhat uncomfortable room. However, in many of regional capital cities, crowding townscape of inner area has been changed

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rapidly since the latter half of 1970's. Rapid increase of high-rise condominiums construction undertaken by private companies and many urban renewal projects planned by local governments are the simultaneous events in inner area.

Several geographical studies have been published on the locational pattern of highrise codominiums and their inhabitants' characteristics (Yui 1986 ; Kagawa 1988, 1990), and also on the community change of inner area (Taira 1990). However, the studies concerning to the distinctive characteristics of inner area's inhabitants in whole city area, and their comparative studies by city have been unexpectedly overlooked. In other words, there have been few discussions on the significance of recent inhabitants' change in inner area in connection with the change of residential structure of whole city.

Thus, it is aimed in this study to clarify the "distinctiveness" in the whole city firstly, and secondly to find out the "simmilarity" by city of the change of inner area's inhabitants. The study performed in the four regional capital cities, that is, Sapporo, Sendai, Hiroshima and Fukuoka.

2. Data and Procedure

The data source used for the analysis are the "Mesh Statistics" of the national population census of 1970 and 1985. The "mesh" is the quadratic section about 500 m × 500 m wide[1], which is used for an unit of the present study. The study area is the "Densely Inhabitated District (DID)".[2] To achieve the objective comparison of the spatial pattern, the study area are divided into five "zones". Zone I is composed of the meshes where the streets of which land value are more than 10% of the highest value of the city are located, which can be recognized as CBD. Zone II is the meshes neighbouring to the CBD. Zone III, IV and V correspond to the meshes newly added to DID in 1960, 1970 and 1985 respectively.[3]

From the "Mesh Statitics", thirty one attributes concerning with demographic and socio-economic characteristics are selected. Every attribute of each "mesh" is summed up by Zone, and then Location Quatients (LQ) of each Zone are computed by respective attributes. The main trends of change of inhabitants' characteristics are clarified by comparing each LQ by Zone, by city, and by year. Moreover, in the case of attributes which seem to represent the main trends, the mesh maps of each city are prepared in order to grasp more detailed spatial pattern.

In the following part of this paper, the outlooks of the four capital cities are presented in the first place (in Chapter III). Then the results of analyses are presented. Firstly the important attributes which seem to characterise the change of inner zone are selected out by inspection on every attribute's change in Zone I (in Chapter IV). And for the next (in Chapter V), characteristics of spatial pattern and its change of the

selected attributes are inspected by LQ patterns and the mesh maps. In the last chapter (Chapter V), the findings are summerized and some discussion on the causal factors which seem to bring about the changes are presented.

3. Outline of four cities

Four cities to be analysed have continuosuly developed after the World War II (Fig. 1) as the regional capital city of Japan. Before going into the analyses, the geographical outlooks of these cities will be briefly presented; particularly on the physical structure such as landform, main traffic route, and location of large industrial complexes, which define the outline of spatial differentiation of the city (Fig. 2a-d).

3.1. Sapporo: Sapporo is a fully planned city constructed at the beginning of the *Meiji* Era as a governmental center of national project of Hokkaido's development. Since then, Sapporo has continuously developed as a capital of the Hokkaido. The southwestern half of the city area is mountainous region and tablelands formed by volcanic activity, and the northeastern half is fluvial plains with peaty soil. On a broad fluvial fan in the middle of them, CBD (Zone I) and old inner area (Zone II, III) locate. According to such topographiical outline, main traffic routes are running from northwest to southeast, and along them, factory and wholesale complexes locate. With the winter olympics in 1972, the subway was developed between the city center and northern and southern residential suburbs. Urbanization has proceeded mainly along these traffic routes.

3.2. Sendai: Sendai originated from a castle town of feudal age, and has developed as the administrative center in the Tohoku district after the *Meiji* Restoration.

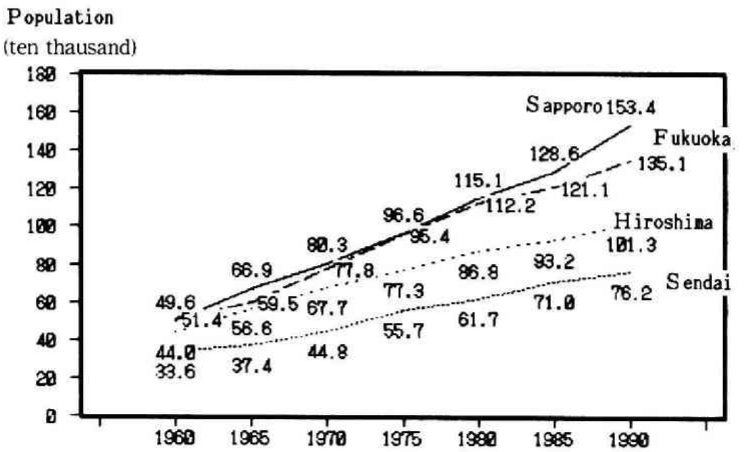


Fig. 1 Change of population.

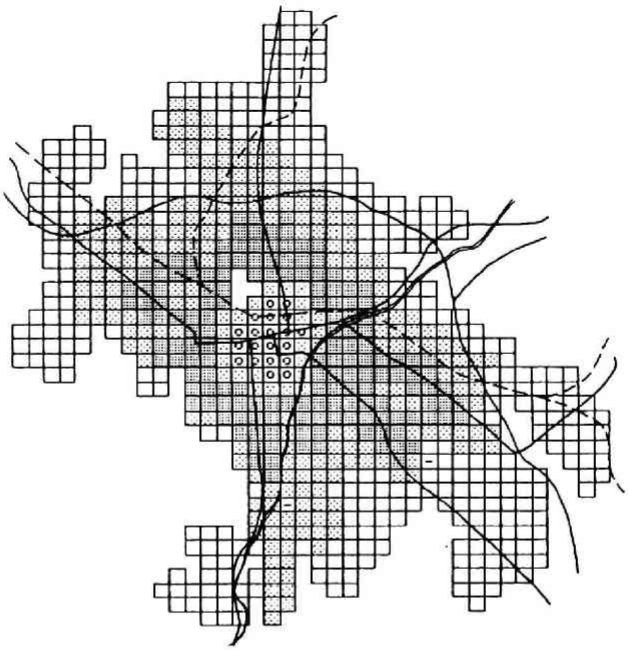


Fig. 2-a Sapporo

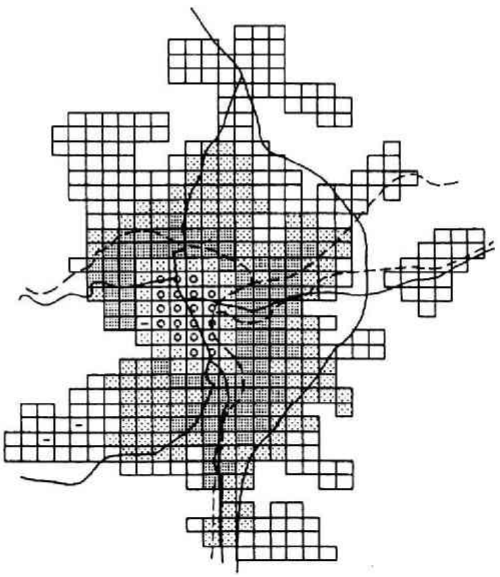


Fig. 2-b Sendai

Fig. 2 Study area and

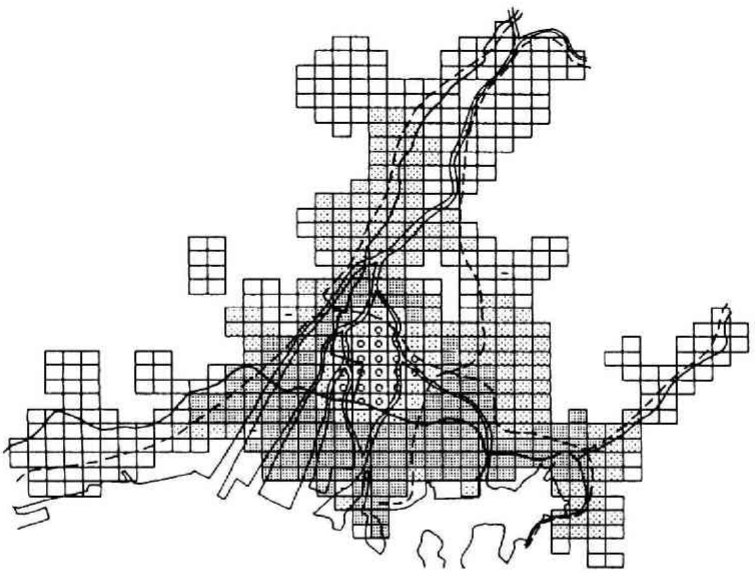


Fig. 2-c Hiroshima

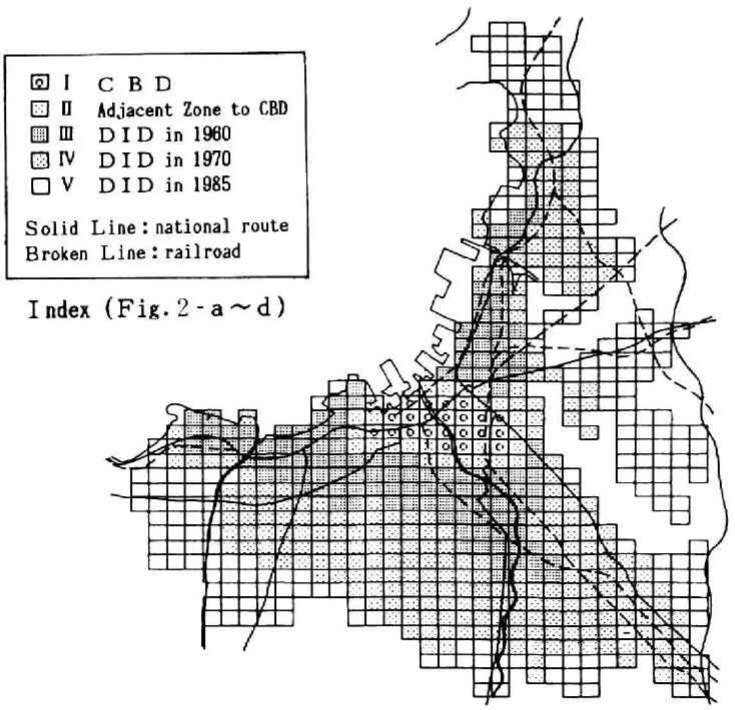


Fig. 2-d Fukuoka

zonal division.

The city area can be divided into the hilly northwestern half and the low and flat southeastern half. On the river terraces in the middle of them, there locate the CBD (Zone I) and old inner city (Zone II, III). Since the latter half of 1960's, the hilly lands have rapidly been developed as the region of residential complexes, and, in the eastern lowland, some large wholesale and factory complexes were developed. Then, the northwestern hilly residential half and the southeastern industrialized lower half show rather contrastive differentiation.

3.3. Hiroshima: Hiroshima also originated from a feudal castle town, and has developed as one of the most important military bases in Japan after the *Meiji* Restoration. In spite of the entire destruction in 1945, Hiroshima has rapidly recovered and has developed as the administrative center of the Chugoku district. The old city area (Zone I~III) located on the river delta, which is surrounded closely by mountainous uplands except for southern coastal plain. Big factories locate on the coast, and many smaller factories are developed to the inlands along the river valleys. Many of the newly developed residential complexes locate on the sloping uplands surrounding the downtown and the bottom plain of northern inland valleys.

3.4. Fukuoka: Fukuoka is a "twin city" composed of ancient port town of Hakata and a feudal castle town of Fukuoka. After the *Meiji* Restoralation, Fukuoka developed as a commercial center of the transit trade between China and the northern Kyushu industrial region. After the World War II, Fukuoka has developed as the administrative center of the Kyushu district. The city area can be divided into western uplands, eastern fluvial plain, and northern coastal suburbs. Naka River can be recognized as the border of western and eastern parts. On the lowest reaches of the Naka River, there are feudal town area or the CBD (Zone I). On the eastern lowlands and the port area, heavy industries and indsutrial and distributional complexes locate, and many residential complexes have been developed on the western uplands and northern coastal region. Recently the built-up area has been rapidly expanding to the every direction.

4. Change of inhabitants' in four inner cities

Table 1 shows thirty one attributes used in the analysis. The change of the attributes in Zone I of every city is shown in Table 2, where ① value of 1985, ② its difference from 1970, and ③ its change rate are presented. By inspection of the table, following chief trends which are notably common to the cities can be found out.

4.1. Age structure: Increase of "Advanced Age" ratio is the most remarkable change in all cities. In Sapporo and Hiroshima, it has increased in rather large degree, that is, nearly doubled. Among the other attributes, "Infant Age" ratio shows steep decrease particularly in Sapporo, Hiroshima and Fukuoka, and "School Age"

Table 1 Demographic and Social Attributes of Inhabitants

category	No.	attributes of inhabitants	abbreviation
Age structure	1	% of 0~4 aged population	"Infant Age"
	2	% of 6~17 aged population	"School Age"
	3	% of 20~64 aged population	"Adult Age"
	4	% of population aged 65 and over	"Advanced Age"
Industrial composition	5	% of workers in construction	"Construction"
	6	% of workers in manufacturing	"Manufacturing"
	7	% of worers in transportation and communication	"Transp/Communic"
	8	% of workers in wholesale and retail	"Wholesale/Retail"
	9	% of workers in service indutries	"Services"
	10	% of workers in finance, insurence and real estate agency	"Finance/Estate"
	11	% of workers in public service	"Public Service"
Occupational composition	12	% of professional, technical and managerial workers	"Professionals"
	13	% of clerical workers	"Clerical"
	14	% of sales and independent service workers	"Sales/Service"
	15	% of production process workers, craftsmen and laborers	"Production Laborer"
Working women	16	% of working women per 15~64 aged women	"Working Women"
Self-employed and related attributes	17	% of self-employed	"Self-employed"
	18	% of family workers	"Family Workers"
	19	% of people working at their home	"Home Workers"
Type of family	20	% of household with one person	"Single Person H'hold"
	21	% of household with two person	"Two Person H'hold"
	22	% of household with 3 or 4 person	"Small Family"
	23	% of household with 5 person and over	"Large Family"
	24	% of quasi-household	"Quasi-household"
	25	% of household of nuclear family	"Nuclear Family"
Ternure of dwelling	26	% of household living in own house	"Own House"
	27	% of household living in rented house owned by local government	"Rented publicly"
	28	% of household living in rented house owned by privately	"Rented privately"
	29	% of household living in issued house	"Issued House"
	30	% of household living in rented rooms	"Rented Room"
Floor space	31	floor space (number of *tatami**) per capita	"Floor Space"

* *Tatami* is rectangular shaped floor mat of which size is 90 cm×180 cm wide.

Table 2 Change of Demographic and Social Attributes in Zone I*

No	attributes	Sapporo ① 1985	Sapporo ② '85−'70	Sapporo ③ ②÷'70 ×100	Sendai ① 1985	Sendai ② '85−'70	Sendai ③ ②÷'70 ×100	Hiroshima ① 1985	Hiroshima ② '85−'70	Hiroshima ③ ②÷'70 ×100	Fukuoka ① 1985	Fukuoka ② '85−'70	Fukuoka ③ ②÷'70 ×100
1	Infant Age	3.34	−1.84	−35.52	4.87	−0.57	−10.40	4.06	−1.03	−20.20	4.55	−2.00	−30.53
2	School Age	9.62	−3.42	−26.23	13.31	−1.75	−11.62	13.48	−0.48	−3.44	11.60	−0.02	−6.60
3	Adult Age	68.14	0.66	0.98	65.59	1.08	1.67	65.25	−3.51	−5.10	68.19	0.83	1.23
4	Advanced Age	12.25	5.54	82.56	9.24	2.33	33.72	12.37	6.24	101.79	10.68	4.17	64.06
5	Construction	5.46	−1.91	−25.92	5.44	−2.32	−30.17	5.41	−1.06	−16.38	5.61	0.38	7.27
6	Manufacturing	5.28	−3.21	−37.81	4.62	−4.45	−49.06	7.18	−2.64	−26.88	6.23	3.82	38.01
7	Transp/Communic	2.49	−0.43	−14.73	3.50	−0.69	−16.47	3.31	−0.64	−16.20	3.38	−0.31	−8.40
8	Wholesale/Retail	47.53	−0.03	−0.06	44.97	1.65	3.81	45.63	−2.11	−4.42	50.80	−1.25	−2.40
9	Services	29.14	3.44	13.39	29.69	2.48	9.11	27.45	3.91	16.61	25.09	2.59	11.51
10	Finance/Estate	7.11	1.86	35.43	8.04	3.12	63.41	6.22	2.13	52.08	6.01	1.81	43.10
11	Public Service	1.77	0.03	1.72	2.39	−0.31	−11.48	3.42	−0.21	−5.79	1.44	0.10	7.46
12	Professionals	20.81	11.50	123.52	25.81	12.33	91.47	21.06	12.40	143.19	16.10	7.72	92.12
13	Clerical	17.05	1.47	9.44	19.25	−0.45	−2.28	18.22	2.58	16.50	18.02	2.67	17.39
14	Sales/Service	47.47	5.83	14.00	43.00	7.98	22.79	44.07	6.82	18.31	49.65	7.71	18.38
15	Production Laborer	12.16	−6.29	−34.09	9.73	−6.21	−38.96	12.66	−3.68	−22.52	13.40	−5.09	−27.53
16	Working Women	62.01	−5.24	−7.79	59.96	−0.11	−0.18	68.57	0.47	0.69	68.70	0.23	0.34
17	Self-employed	17.06	2.90	20.48	15.03	0.04	0.27	18.38	1.18	6.68	17.50	0.13	0.75
18	Family Workers	5.92	−2.73	−31.56	6.85	−2.80	−29.02	8.11	−2.27	−21.87	8.28	−4.00	−32.57
19	Home Workers	17.40	−14.38	−45.25	18.89	−13.74	−42.11	20.25	−12.97	−39.04	18.40	−18.41	−50.01
20	Single Person H'hold	56.45	21.55	61.59	51.44	20.75	67.61	47.23	16.62	54.30	52.38	24.26	86.27
21	Two Person H'hold	20.98	1.87	9.79	17.88	1.01	5.99	22.24	0.68	3.15	19.67	−0.18	−0.91
22	Small Family	17.76	−8.96	−33.53	22.92	−7.70	−25.15	23.57	−8.71	−26.98	21.74	−7.73	−26.23
23	Large Family	4.37	−11.01	−71.59	7.26	−10.08	−58.13	6.47	−5.49	−45.90	5.67	−12.03	−67.97
24	Quasi-Household	5.91	−7.23	−55.02	7.17	−7.07	−49.65	6.87	−2.60	−27.46	8.96	−0.08	−0.88
25	Nuclear Family	35.67	−17.60	−33.04	38.59	−17.28	−30.93	43.72	−13.58	−23.70	38.60	−16.28	−29.66
26	Owned House	29.20	−0.93	−3.09	33.06	−3.02	−8.37	34.28	2.39	7.49	27.89	−2.47	−8.14
27	Rented publicly	4.31	0.41	10.51	2.54	0.71	38.80	6.55	−2.52	−27.78	10.15	2.04	25.15
28	Rented privately	57.90	6.80	13.31	51.94	3.25	6.67	47.93	−0.97	−1.98	52.09	0.52	1.01
29	Issued House	6.64	−3.25	−32.86	9.81	−1.26	−11.38	9.70	2.27	30.55	7.21	0.13	1.84
30	Rented Room	1.96	−3.02	−60.64	2.65	0.32	13.73	1.53	−1.17	−43.33	2.65	−0.23	−7.99
31	Floor Space	10.61	3.91	58.36	9.74	3.63	59.41	9.58	3.71	63.20	9.08	3.57	64.79
31′	〃 (whole City)	9.86	3.52	55.52	8.80	3.06	53.31	8.79	3.04	52.87	8.48	3.11	57.91

* Numer of meshes ··· Sapporo : 20, Sendai : 20, Hiroshima : 19, Fukuoka : 22

ratio has also reduced particularly in Sapporo and Sendai.

4.2. Industrial composition of employed person: The ratios of workers of "Construction", "Manufacturing" and "Transp/Commnunic" have fairly reduced in almost all cases except Fukuoka's "Construction" workers. On the contrary, "Services" and "Finance/Estate" workers' ratios show remarkable increase. In short, reduction of blue-collar industries' workers and increase of white-collar industries' workers are the general tendency from 1970 to 1985. These changes are thought to be brought by recent movement of deindustrialization. Besides, it is worthy to note that the ratio of workers in "Wholesale/Retail", which is generally recognised as one of important function in CBD, has reduced in every city except Sendai.

4.3. Occupational composition of employed person: Simmilar trends are found out in the occupational composition. Coincident with the change of industrial composition, the ratio of blue-collar workers such as "Production" showed remarkable reduction, and the one of white-collar workers such as "Professionals", "Clerical" and "Sales/Service" showed increase in most cases. Particularly, "Professionals" shows rather drastic increase in every city. This is very important change in inner city, because "Professionals" have been recognized as one of the typical attributes which shows "sectorial" spatial differentiation.[4]

4.4. Working women: Ratio of "Working Women" has been recognized as a typical "concentric" type of attribute.[5] Table 2 shows, however, that it didn't increase so clearly in Sendai, Hiroshima and Fukuoka, and in Sapporo it has just remarkably decreased. This seems to be rather strange if we taken into consideration recent development of service industries and women's employment.

4.5. Self-employed and related attributes: Because "Self-employed", "Family workers" and "Home workers" are closely correlated each other,[6] all of them must be referring to the small domestic traders or manufacturers. However, although the latter two attributes showed steep reduction, "Self-employed" didn't show any decrease in all cities; in Sapporo it has just increased in some degree.

4.6. Type of family: The most notable change is drastic increase of "Single Person H'hold". It has doubled in Sapporo and Sendai and steeply increased in other two cities. Against that, most of the other attributes which concerned with the larger families showed significant decrease. One of the reason for such remarkable increase of "Single Person H'hold" is that people who lived in boardinghouses or dormitories who were defined as "Quasi-household" in 1970 have changed their dwelling to the new type apartments or condominiums designed for single persons, and have changed their household type from "quasi-" household to one person "ordinary" household in 1985. However, it can be considered that there is another factor in "Single Person H'hold"'s steep increase, because the extent of it's increase is rather larger than quasi-household's decrease. Namely, simulatneous increase of "Advanced Age" and "Professionals"

implies that the inner city-oriented single person bouseholds have newly emerged in these fifteen years.

4.7. Tenure of dwelling: "Own House" and "Rented privately" have far larger percentages than the other attributes. To examine both attributes, "Rented privately" has enlarged its percentage in Sapporo and Sendai on one hand, on the other hand, "Own House" has increased only in Hiroshima. In the case of the other attributes, "Rented publicly" shows larger percentage in Hiroshima and Fukuoka than the other two cities, and "Issued House" does in Sendai and Hiroshima. In short, and common trends to four cities are hardly found out, which is considered to be reflecting each city' s own conditions of housing stock or industrial structures.

4.8. Floor space: "Floor Space" per capita has sharply increased from 1970 to 1985. To compare the extent of increase in Zone I with the one in whole study area shown in the bottom row of Table 2, it can be grasped that Zone I shows rather larger increase than whole study area. This indicates that the residential condition of the inner city has significantly been improved in these fifteen years.

Above mensioned trends of the inhabitants' change in four inner cities can be summerized as Table 3, where the important attributes and their general trends are presented. These are as follows:

① Age structure: steep increase of advanced age and reduction of infant age
② Industrial and occupational composition (1): steep reduction of blue-collars and remarkable increase of white-collars, particularly steep increase of "Professionals",
③ Industrial and occupational composition (2): such "concentric" type attributes' unexpected reduction as "Wholesale/Retail" and "Working Women",
④ Self-employed and related: steep reduction of family and home workers,

Table 3 Chief attributes which showed notable change

trend / category	remakable increase	remarkable decrease	unexpected stagnation
Age structure	Advanced Age	Infant Age	
Industrial and occupational structure	Professionals Finance/Estate Services Sales/Service	Manufacturing Production Laborer	Wholesale/Retail Working Women
Attributes related to Self-employed		Faminly workers Home workers	
Family type	Single Person H'hold	Large family	
Dwelling Tenure	(Any common trends were not clearly found out.)		
Floor space	Floor Space		

⑤ Family type : drastic increase of "Single Person" household,
⑥ Dwelling tenure : any common trend was not clearly found out,
⑦ Floor space : obvious improvement particularly in inner area.

Then, more detailed understanding on change of the inhabitants' spatial pattern is achieved using LQ and mesh maps, in the next chapter.

5. Change of spatial patterns of the important attributes

Table 4 indicates Location Quatient (LQ)[7] and their change between 1970 and 1985. The attributes shown in the table are the ones presented in Table 3 except for "Rented privately" which was added on to grasp the trend of dwelling tenure in part. Needless to say, even if the ratio had increased in some percentage, its LQ would not increase unless it exceeds the whole area's percentage. Namely, the LQ indicates the relative evaluation of each zone in the whole area, that is, relative spatial structure.

In Table 4, the LQ over unity means that the zone can be defined as "specialized" in particular attribute. The attribute of which LQ shows the highest specialized value in Zone I and lessens to the outer zone can be judged as "concentric" type, and the attribute with the reverse pattern as "dispersed" type. Although most of presented attributes can be commonly judged as "concentric" and some ones as "dispersed" in all cities, several cases show different pattern by city or by year.

Paying attention to the extent of "concentration" or "dispersion" and their changes, trends of spatial patterns of each attribute were examined. Findings are summerized in the following four cases.

5.1. Age and household structure

As shows in the preceding chapter, the most remarkable changes in age structure are the rapid increase of aged population and decrease of infant population. As presented in the upper row of Table 4, "Advanced Age" indicated high specialization in Zone I and II in 1970. In 1985, although such patterns are basically unchanged, it is the genreral trend that LQs have rised in larger degree in Zone III and IV than in Zone I. In short, the concentrated area of the aged population has been shifting from inner area to the outer zone.

The attributes which have simmilar pattern to this are "Single Person" household and "Rented privately". It can be observed that both attributes have expanded the specialized zone to outer part more remarkably than "Advanced Age". Thus, generally speaking, these attributes can be defined as "expanding inner specialized zone" type.

Paying attention here to the mesh maps of "Advanced Age" shown in Fig. 3, it can be recognized that the spatial pattern has become to show more typical concentric

Table 4 Location Quatient by Zone

Attributes	City	Location Quatient (1970) I	II	III	IV	Location Quatient (1985) I	II	III	IV	V	Change of LQ (1985-1970) I	II	III	IV
Advanced Age	Sapporo	■	■	+	--	■	■	−	-	-	.235	−.277	.066	.142
	Sendai	■	■	+	---	■	■	■	•	---	−.064	.091	.154	.286
	Hiroshima	■	■	•	-	■	■	−	-	--	.333	.200	.135	−.031
	Fukuoka	■	■	+	--	■	■	−	-	--	.188	.167	.069	.062
Infant Age	Sapporo	----	----	-	■	----	---	-	+	+	−.081	.051	−.011	−.144
	Sendai	----	--	-	■	---	--	•	•	+	.082	.014	.028	−.245
	Hiroshima	----	--	•	■	----	--	-	+	+	.032	.040	−.069	−.163
	Fukuoka	---	--	-	■	----	---	-	+	+	−.082	−0.73	.032	−.107
Whalesale /Retail	Sapporo	■	■	•	--	■	■	−	•	-	−.001	−0.42	.058	.132
	Sendai	■	+	•	-	■	+	•	•	-	−.045	−.044	.036	.110
	Hiroshima	■	■	-	--	■	■	•	-	-	−.188	−.028	.072	.131
	Fukuoka	■	■	•	--	■	■	•	•	-	−.113	.025	.024	.124
Services	Sapporo	■	+	•	-	+	+	−	•	•	−.121	−.013	.031	.067
	Sendai	■	+	•	-	+	■	−	•	-	−.035	.073	.081	.059
	Hiroshima	■	+	•	--	■	■	•	-	•	−.123	.030	.038	.078
	Fukuoka	•	•	•	•	•	•	−	•	-	−.050	.020	.048	.007
Sales/ Service	Sapporo	■	■	•	--	■	■	−	•	--	−.055	.002	.090	.156
	Sendai	■	+	•	--	■	■	•	•	-	−.020	.044	.051	.069
	Hiroshima	■	■	-	---	■	■	•	-	-	.001	.046	.076	.063
	Fukuoka	■	■	•	--	■	■	•	-	--	−.050	.062	.036	.073
Working Women	Sapporo	■	■	•	--	■	■	+	-	--	−.194	−.060	.073	.107
	Sendai	■	+	•	-	■	+	•	•	-	−.020	.044	.051	.069
	Hiroshima	■	+	•	-	■	■	•	-	-	.001	.046	.076	.063
	Fukuoka	■	■	•	-	■	■	•	-	-	−.050	.062	.036	.073
Family Workers	Sapporo	■	■	•	---	■	■	+	--	•	.138	.201	.013	.140
	Sendai	■	■	-	---	■	■	•	--	-	.125	−.077	.109	.118
	Hiroshima	■	■	-	--	■	■	•		--	.181	.042	.090	.062
	Fukuoka	■	■	-	--	■	■	-	-	-	.034	.052	.008	.101
Home Workers	Sapporo	■	■	•	---	■	■	•	--	-	.024	.166	.070	.142
	Sendai	■	■	-	---	■	■	•	--	-	−.175	.075	.142	.168
	Hiroshima	■	■	--	--	■	■	•	--	-	−.071	−.037	.137	.081
	Fukuoka	■	■	-	--	■	■	-	-	-	−.256	−.043	.037	.147
Production Laborer	Sapporo	----	--	•	+	----	---	-	+	+	−.079	−.061	−.098	−.063
	Sendai	----	-	•	+	----	---	•	+	+	−.135	−.139	−.066	−.079
	Hiroshima	----	--	+	+	----	---	•	+	•	−.032	−.066	−048	.001
	Fukuoka	---	•	•	+	----	--	--	+	■	−.054	−.163	−.132	−.020

Table 4 (Continued)

Attributes	City	Location Quatient (1970) I	II	III	IV	(1985) I	II	III	IV	V	Change of LQ (1985-1970) I	II	III	IV
Finace /Estase	Sapporo	·	-	+	-	+	·	+	·	--	.196	.105	.072	.037
	Sendai	-	+	-	+	#	#	+	·	--	.406	.195	.108	−.086
	Hiroshima	+	·	·	·	+	+	·	·	·	.154	.071	−.014	.020
	Fukuoka	--	--	+	-	·	·	#	-	--	.187	.229	.061	.003
Profes-sionals	Sapporo	--	-	·	·	+	·	·	-	·	.293	.099	.011	−.045
	Sendai	-	+	·	·	#	#	·	-	-	.432	.080	.023	−.038
	Hiroshima	-	·	·	·	+	+	·	-	·	.294	.106	−.035	−.092
	Fukuoka	---	---	+	+	-	·	-	·	-	.237	.259	.020	−.069
Single Person Household	Sapporo	#	#	+	----	#	#	#	-	----	.273	.117	.258	.307
	Sendai	#	#	·	--	#	#	#	-	----	.261	.249	.260	.156
	Hiroshima	#	#	·	----	#	#	+	--	----	.086	.085	.197	.259
	Fukuoka	#	+	+	---	#	#	+	--	----	.224	.311	.159	.088
Large Family	Sapporo	·	-	·	+	----	----	---	·	#	−.541	−.361	−.250	−.099
	Sendai	·	·	·	·	----	---	--	·	#	−.409	−.356	−.181	.020
	Hiroshima	-	-	·	#	----	---	--	+	#	−.284	−.254	−.160	−.067
	Fukuoka	·	·	-	+	----	----	---	+	#	−.456	−.393	−161	.008
Rented Privately	Sapporo	+	#	·	-	#	#	#	+	----	.176	.102	.203	.132
	Sendai	#	#	·	--	#	#	#	·	----	.092	.124	.203	.172
	Hiroshima	·	·	+	-	#	+	#	+	----	.158	.072	.120	.171
	Fukuoka	#	#	·	--	#	#	+	·	----	.024	.059	.079	.162
Floor Space	Sapporo	+	·	·	·	+	·	·	·	·	.019	−.011	−.001	−.022
	Sendai	+	·	·	·	+	·	·	·	·	.042	.012	−.012	−.009
	Hiroshima	·	·	·	+	+	·	·	·	·	.069	.018	−.003	−.091
	Fukuoka	·	·	·	·	+	+	·	·	·	.045	.106	.022	−.039

$$\text{Location Quatient} = \frac{\text{"\% in each zone"}}{\text{"\% in whole study are of each city"}}$$

Index

[#] ≧ 1.50	1/1.50 ≧ [----]
1.50 > [#] ≧ 1.30	1/1.30 ≧ [---] > 1/1.50
1.30 > [+] ≧ 1.15	1/1.15 ≧ [--] > 1/1.30
1.15 > [+] ≧ 1.05 > [·] > 1/1.05 ≧ [-] > 1/1.15	

pattern in every city, particularly in Sapporo, Hiroshima and Fukuoka. Moreover, in Sendai and Hiroshima, the densely distributed area has clearly expanded to outer zone.

On the contrary, the infant population ratio indicates the opposite LQ pattern commonly in all cities. However, the outer zone which had showed remarkable specialization in 1970 have reduced its LQs substantially in every city in 1985, that is, the infant population has reduced not only in inner zone but also evenly in all zones.

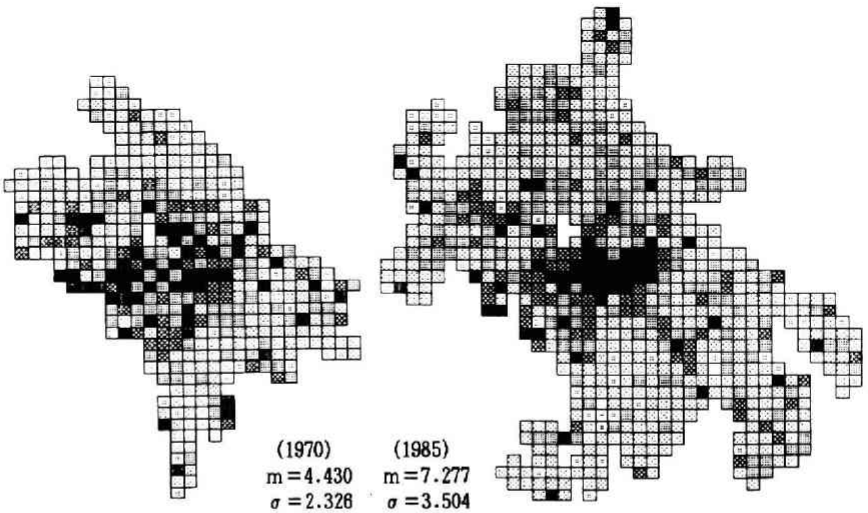
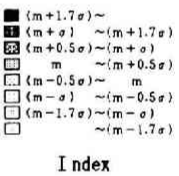


Fig. 3-a Sapporo



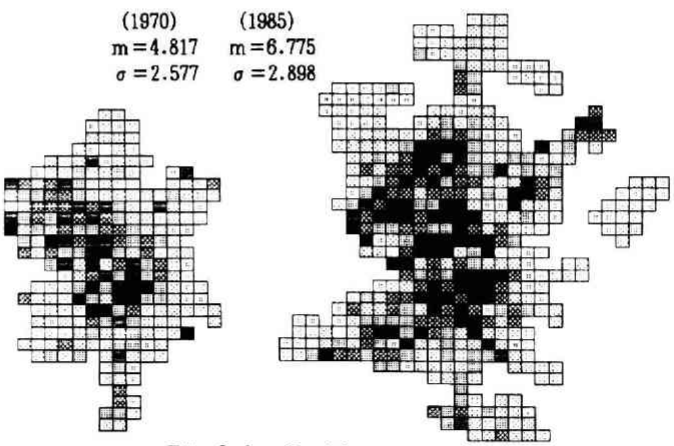


Fig. 3-b Sendai

Fig. 3 Ratio of Advanced

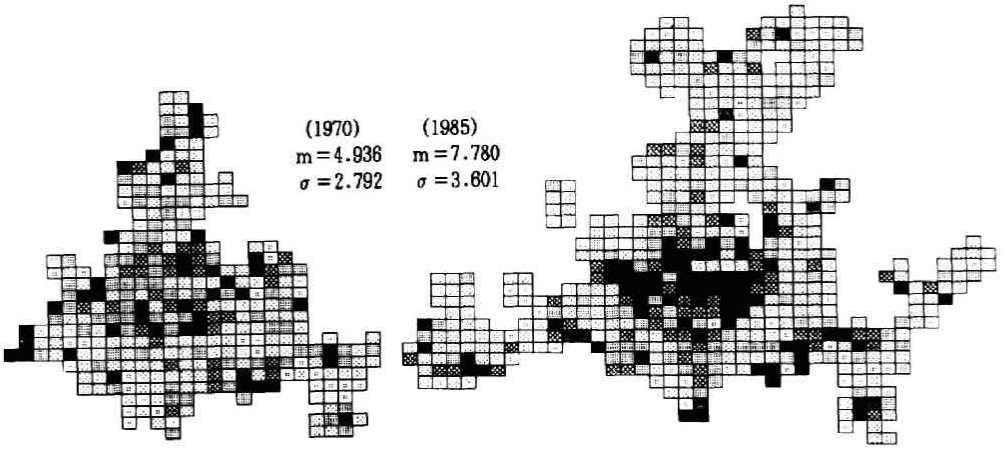


Fig. 3-c Hiroshima

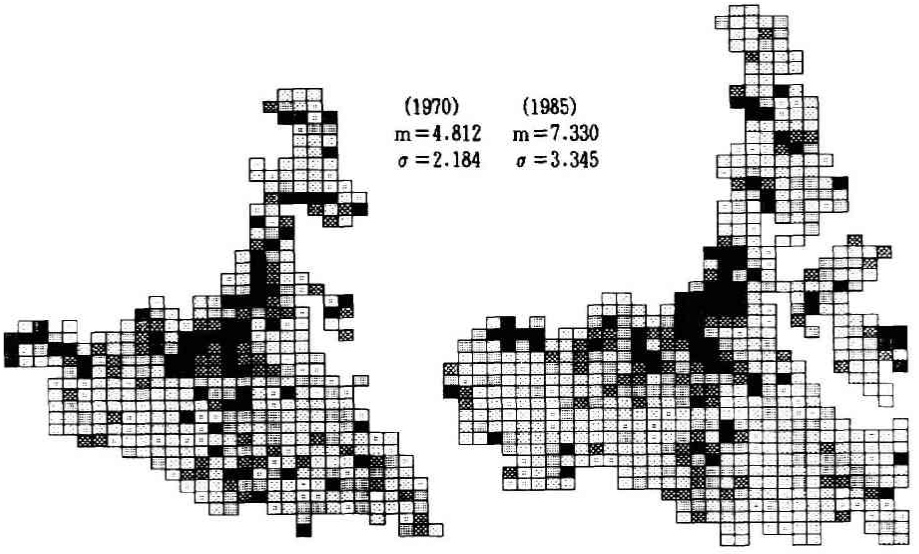


Fig. 3-d Fukuoka

Age Population

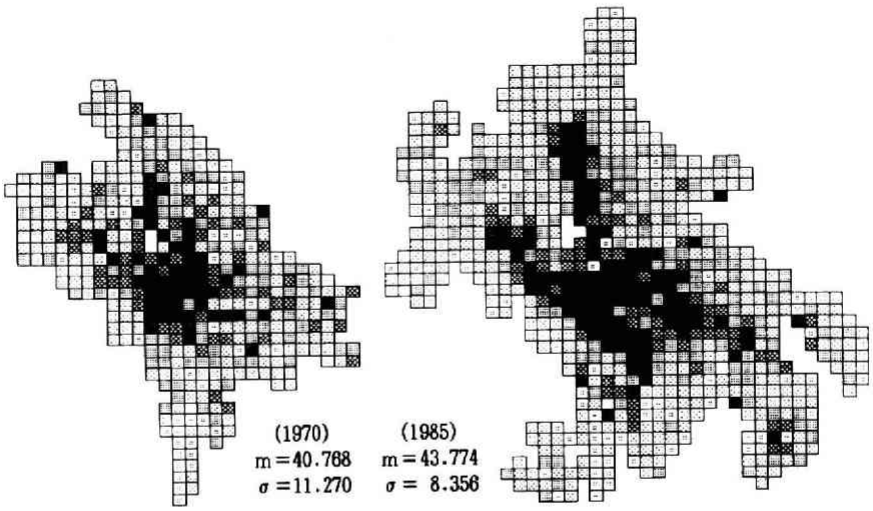
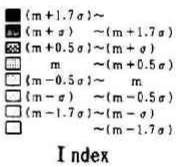


Fig. 4-a Sapporo



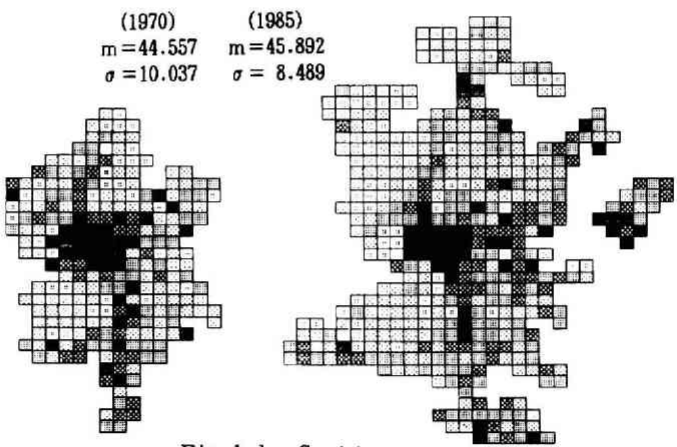


Fig. 4-b Sendai

Fig. 4 Ratio of

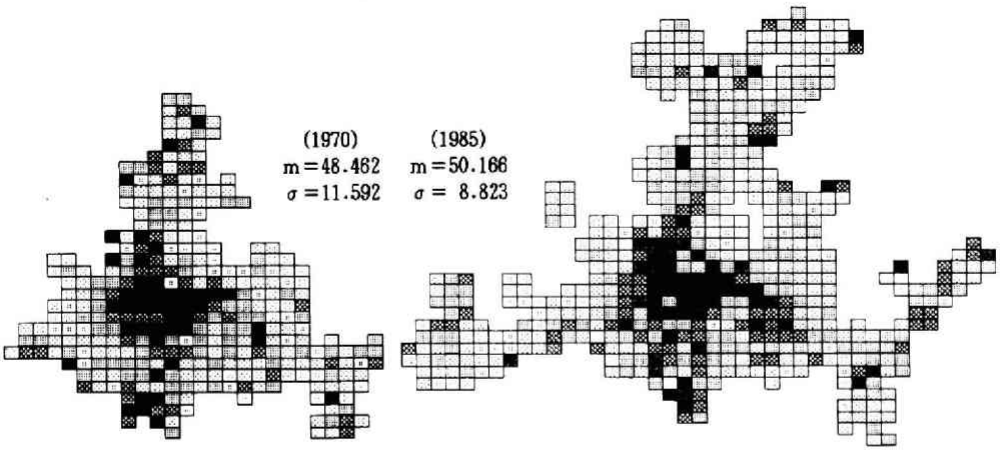


Fig.4-c Hiroshima

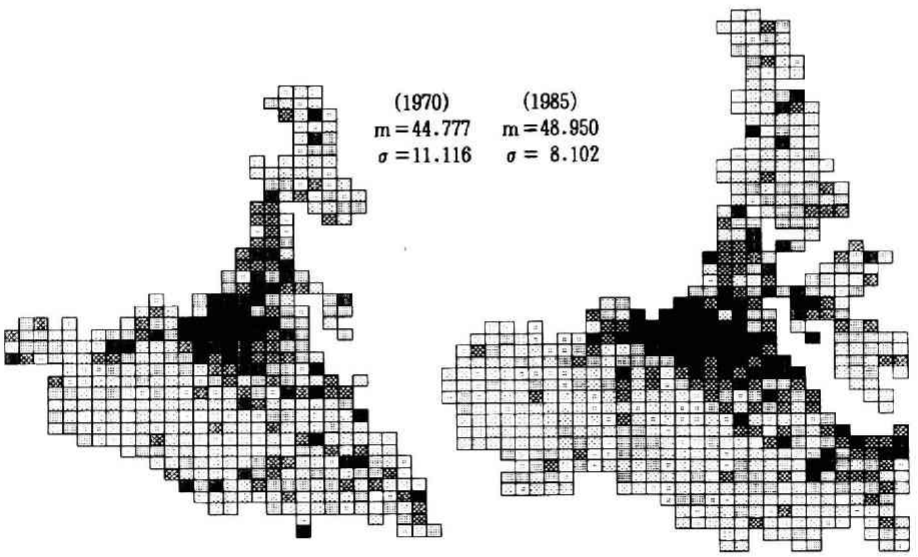


Fig.4-d Fukuoka

Working Women

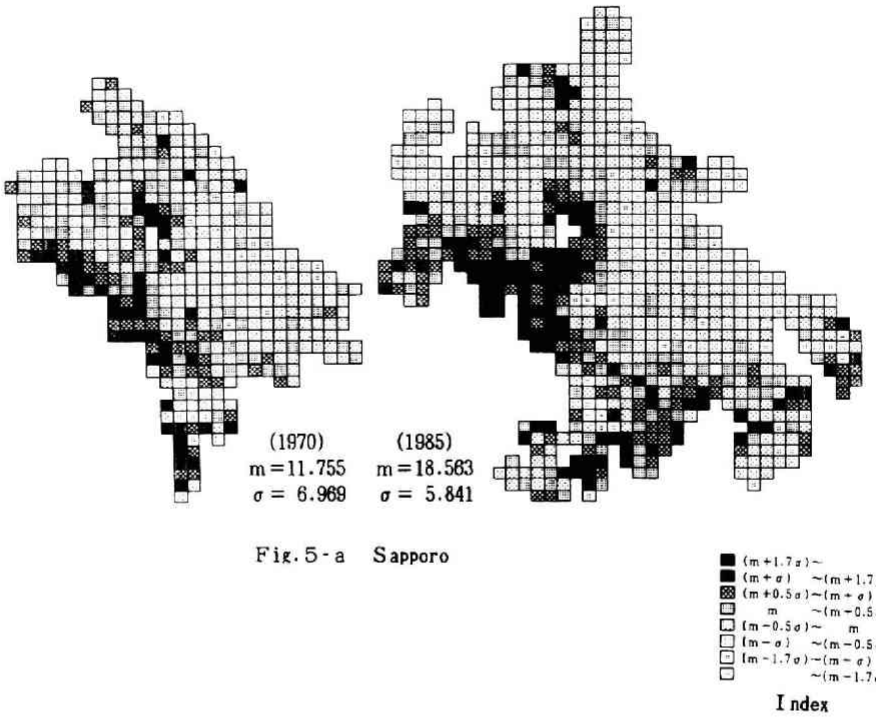


Fig. 5-a Sapporo

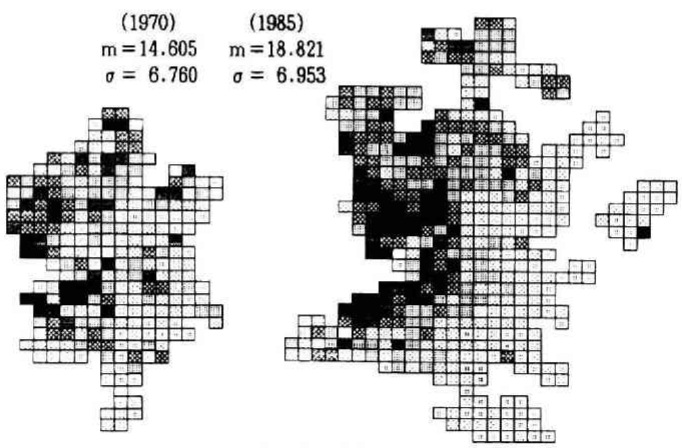


Fig. 5-b Sendai

Fig. 5 Ratio of

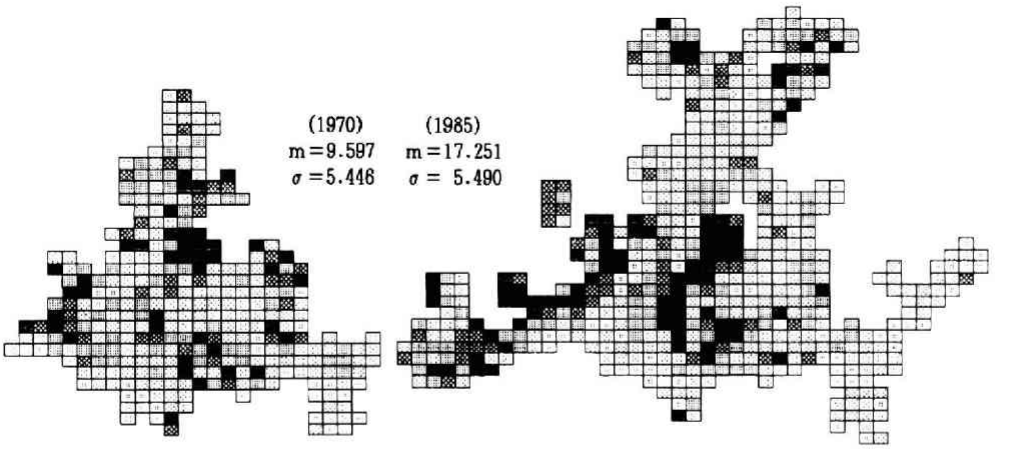


Fig.5-c Hiroshima

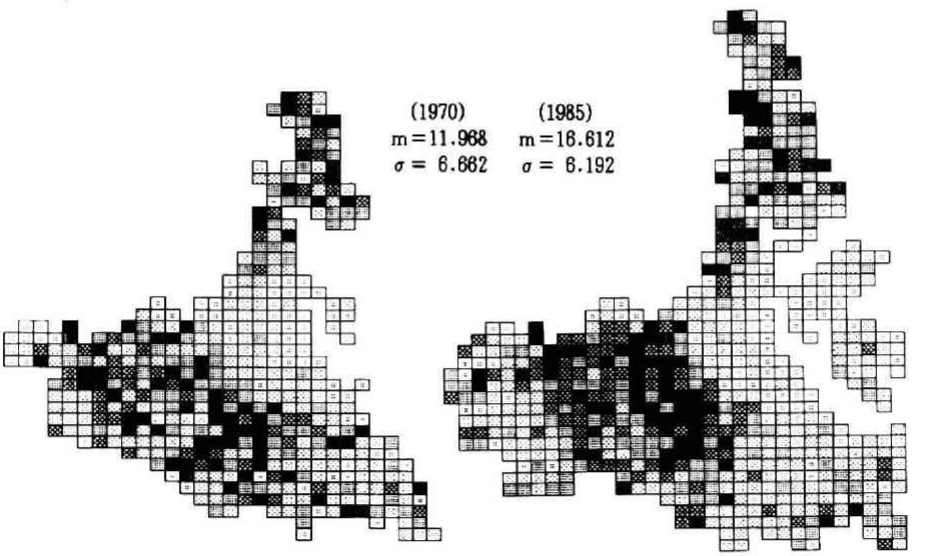


Fig.5-d Fukuoka

Professional Workers

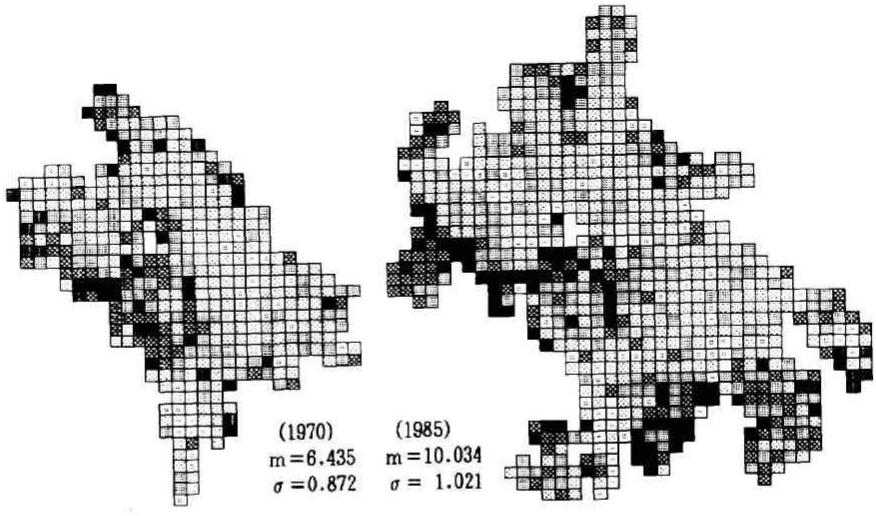
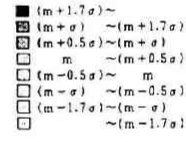


Fig. 6-a Sapporo



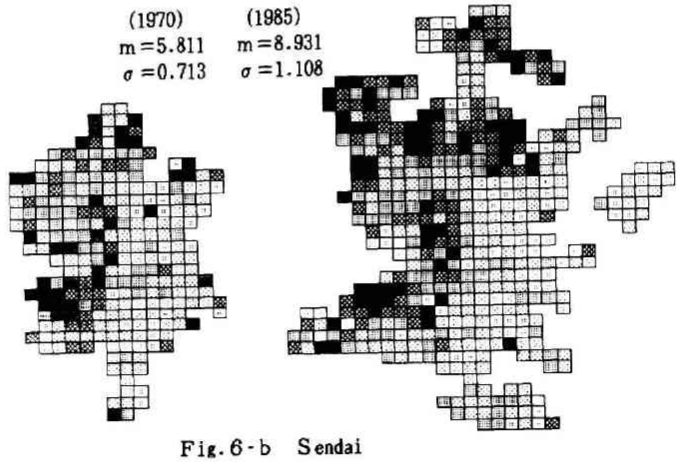


Fig. 6-b Sendai

Fig. 6 Floor Space

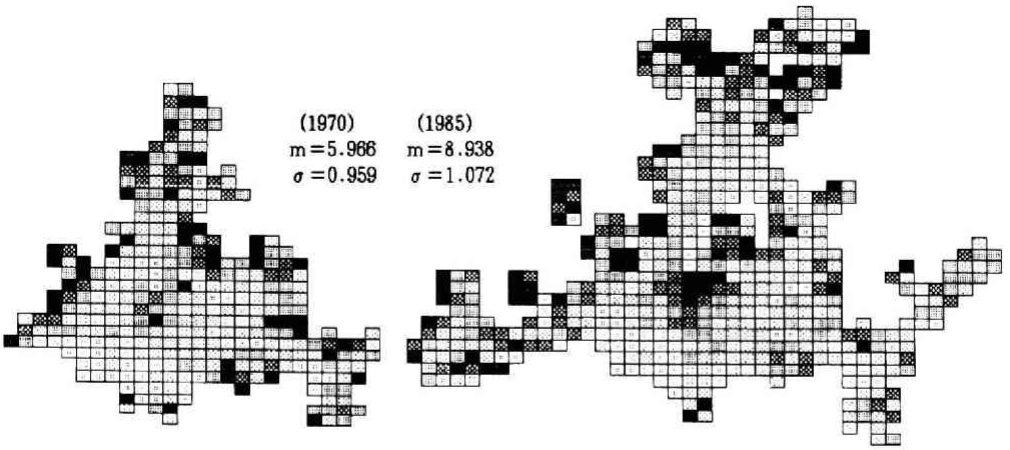


Fig. 6-c Hiroshima

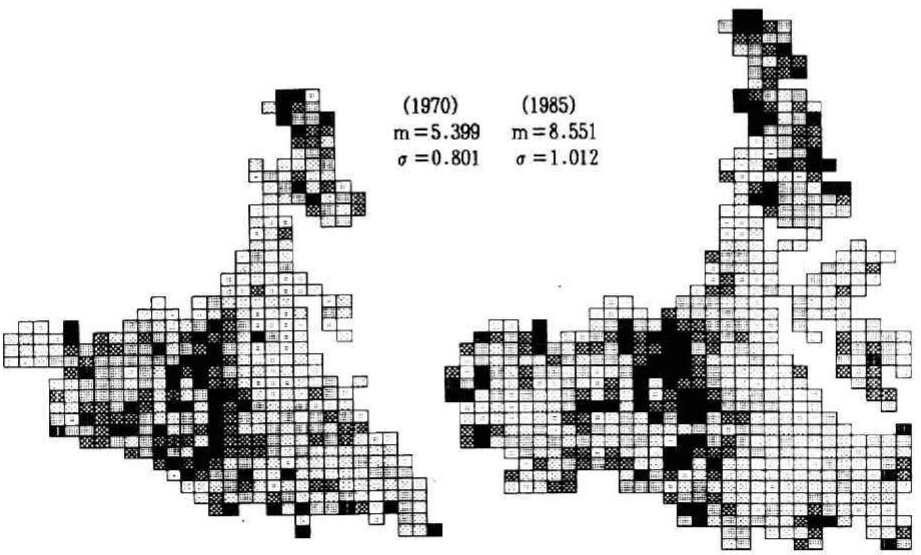


Fig. 6-d Fukuoka

(number of tatami) per capita

5.2. Commercial facilities and working women

"Wholesale/Retail", "Services", "Sales/Service" and "Women Worker" are chiefly concerning with commercial activities in CBD, and have generally been recognised to show typical "concentric" pattern. In the present study, similar concentric pattern were recognised too, as shown in the preceding chapter. And this seemingly resembles the pattern of aged population. However, the patterns of change in LQ are apparently different from the aged population, that is, the LQs have decreased in Zone I of almost all cases. This trend suggests that these attributes have dispersed from the inner area to the outer zones, which can be interpreted as the reflection of recent development of suburbs. Thus, these attributes can be defined as "dispersing from inner zone" type.

As an example, spatial pattern of "Working Women" are shown in Fig. 4. Though the spatial pattern shows the "concentric" pattern, the higher valued meshes have increased around CBD and outer part in the city. In Sapporo, for example, the higher valued meshes have dispersed particularly to the southeastern residential zone, to northern center of Azabu district, and to Kotoni district on the northwest of CBD. In Sendai, high valued meshes have emerged in the newly developed wholesale complex area in the eastern lowland. No clear such change is recognised in Hiroshima, however in Fukuoka it is recognised that high valued meshes increased in the southeastern suburbs along the arterial traffic route.

5.3. Family workers, home workers and blue-collar workers

Patterns of "Family Workers" and "House Workers" show the most typical concentric pattern in all cases, and any clear changes can hardly be recognized between 1970 and 1985. However, as we already observed in Table 2, both attributes showed steep reduction in Zone I. Then if we take into consideration the invariability of LQ patterns in whole area in spite of the steep reduction of Zone I, we could recognize that "Family Workers" and "House Workers" have decreased not only in Zone I but also in whole area from Zone I to Zone IV. Thus, both attributes can be defined as "steeply reduced but constantly concentric" type.

On the contrary, the pattern of "Production" workers can be defined as "steeply reduced but constantly dispersed", because the ratio of "Production" workers has decreased in all zones and of which LQ pattern didn't clearly change.

5.4. Change of "sectorial" type attributes

"Finance/Estate" and "Professionals" show different patterns from all types mensioned above. That is to say, wheareas their LQs didn't show any specialization in Zone I in 1970, they have changed to show apparent specialization in Zone I in 1985. Namely, these can be defined as "newly concentrating" type. In the case of Fukuoka,

although there is no specialization in Zone I, it can also be defined as the similar type, because its LQ has markedly increased in 1985.

If we look at Fig. 5, the spatial pattern of "Professionals" shows that they have remarkably increased in inner area in 1985, although the meshes which indicated the high value in 1970 located mainly on particular sector in outer zone. That is, the obvious increase can be observed in the western half of the CBD in Sapporo and Sendai, around the CBD in Hiroshima, and in southwestern adjacent area of the CBD in Fukuoka.

Similar trend can be observed in the case of "Floor Space" as discussed in the preceding chapter. Its mesh maps (Fig. 6) show that the concentration of high valued meshes in inner part has become more apparent in every city. In Sapporo and Hiroshima, such change is rather clear, and in Fukuoka, evident increase are observed in the southwestern side of the CBD just like as "Professionals".

6. Conclusion : Characteristics of recent residential change in inner city

This paper reported the recent change of inhabitants in inner area of four regional capital cities in Japan, using thirty one attributes selected from "Mesh Statistics" in 1970 and 1985. After having divided the study area of each city into some concentric zones, change of each attribute in the central zone (Zone I) of every city were examined at first. Secondly, having selected some attributes which showed remarkable change, their Location Quatients by zone were computed, and using them, zonal pattern and their change were examined.

Seven important trends were sorted out from the former analysis and four spatial patterns were grasped from the LQ analysis. To connect the latter four patterns with the former seven trends and to point out their factors, the findings can be summerized as follows. (The heading number in parentheses indicates the latter four patterns, and the number within circle shows the former seven trends.)

(1) Age and family type : Remarkable increase of "Advanced Age" and decrease of "Infant Age" (①) and steep increase of "Single Person" household (⑤) were found out in inner zone of every city. Their LQ patterns indicated that they had increased not only in inner area but also in the old city zone. On tennure of dwelling, although any common trend were not found out in four inner cities (⑥), "Rented Privately" has gotten LQ value particularly in the old city zone. It can be said that these trends have been brought about by the social trend of aging and break down of family in recent Japan, by deterioration of the old residential zone through the lifestage's advancing and the process known as "filterling", and by the outward shifting of the "transition zone" followed on the development of CBD.

(2) Wholesale and retail function and working women : The most cases of

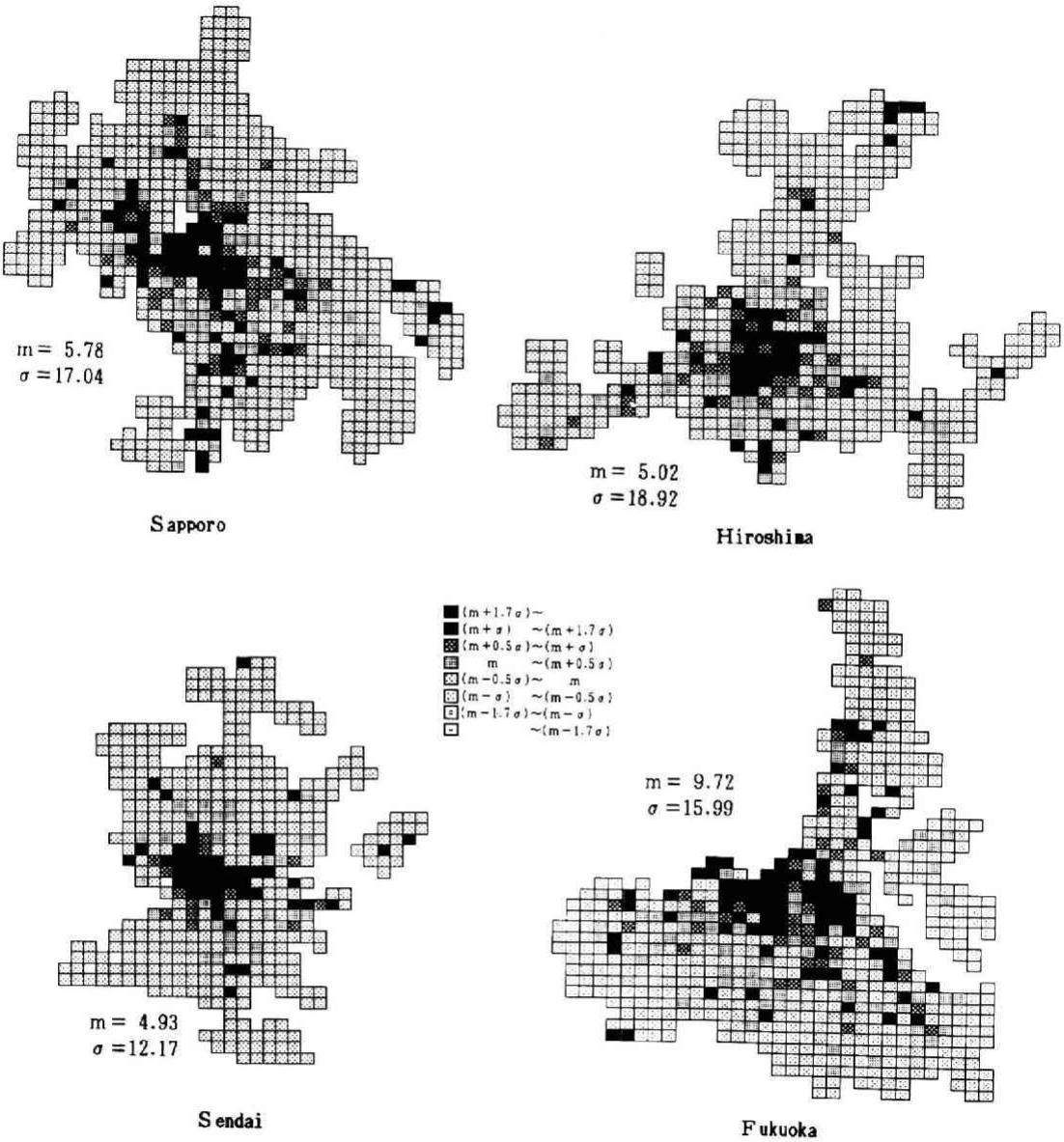


Fig. 7 Ratio of household living in high-rise condominium* (1985)
(*: condominium building with six stories and higher)

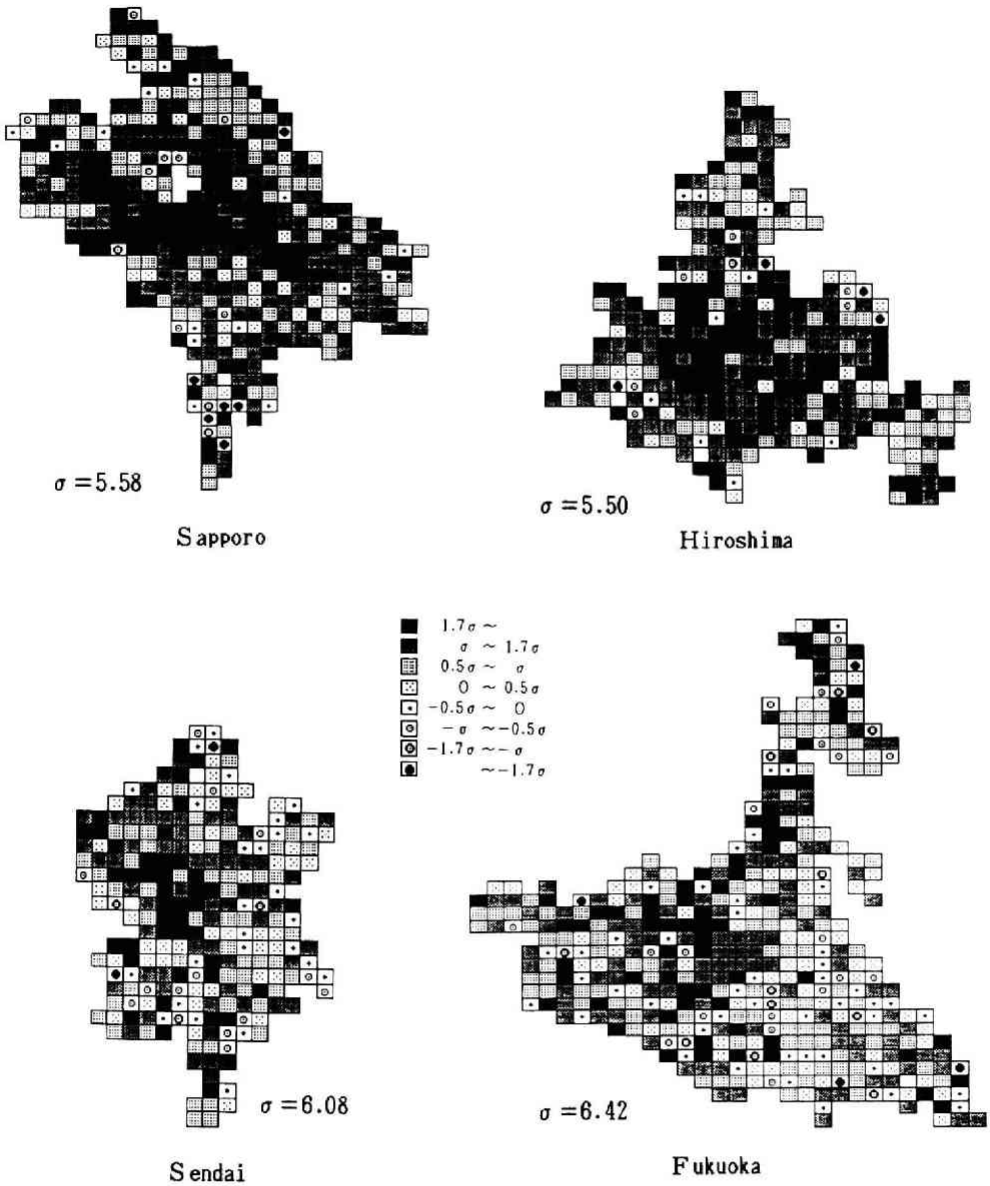


Fig. 8 Change of the ratio of professional workers (1970~1985)

"Wholesale/Retail" and "Working Women" which are recognized as typical "concentric" type attributes unexpectedly showed decrease in inner area (③), in spite of rapid development of every city. Their reduction in inner area also observed on the LQ pattern. These trends can be thought to reflect the dispersion of commercial facilities which are brought about by the development of the new suburbs.

(3) Family workers, home workers and blue-collar workers: Although these attributes showed steep reduction (④), their LQ patterns didn't show so clear change, which means that they reduced in every zone evenly. This trend would suggests that most of self-employed businessmen have ceased from depending on their family workers and have separated their living place from working place, that something new type of self-employed business have emerged, and that deindustrialization occurred all over the city.

(4) Change of "sectorial" type attributes: "Professionals" and "Services" have markedly increased in inner are (②), and the degree of increase of "Professionals" is particularly large. At the same time, its LQ has changed from "non-concentric" pattern to "concentric" type. Moreover, "Floor Space" also showed notable improvement especially in inner area (⑦). "Professionals" and "Floor Space" have been recognized as a typical attribute of "socio-economic status" dimension which shows the "sectorial" differentiation in factorial ecological analysis. In other words, they are representative attributes of the white-collar mainly living in hilly residential sector, which are contrasted with the blue-collar in industrial sector. Therefore their change to concentric type implies that the meaning of this dimension need to the reappraised, and that the inner city's residential characteristics has basically changed.

Generally speaking, under the change of family and industrial structures such as the increase of aged people and single person household, the reduction of infants and blue-collor workers, the dispersion of commercial facilities and the centralization of professional workers, the image of inner area in Japan has changed from the place characterised by densely inhabited retailers, service workers, working women and family workers, to the place with higher prestige workers and more improved residential condition.

It seems that these changes are closely correlated with recent increase of the high rise condominiums constructed by private corporations in inner area. To examine this point, the mesh maps of the ratio of household living in highrise condominium and the ones of difference of professional workers ratio are presented in Fig. 7 and Fig. 8. Although only partial accordance is seen in Fukuoka, close correspondence is recognised in Sapporo, Sendai and Hiroshima.[8]

By the way, the change of inhabitants' characteristics in inner area mensioned above may be considered as a kind of what is called "gentrification", that is, a movement of privately projected residential improvement. However, to consider that

these changes correlate with increase of aged population and single person household, the author has a notion that this "improvement" is restrict to physical condition only. It will, therefore, be neceessary to make further examination as to whether these trends connect with the "improvement" of social quality of the inner community or not.

Acknowledgement

The auther is grateful to Proffessor S. Shimada for correcting the manuscript and giving valuable suggestions.

Notes

1) Area of a mesh is about 509 m × 463 m in Sapporo, 547 m × 462 m in Sondai, 575 m × 462 m in Hiroshima, and 580 m × 462 m in Fukuoka.
2) DID is officially defined "urbanized area", which is composed of a group of contiguous enumeration district of which population density is 4,000 or more inhabitants per square killometer.
3) The mesh whose population is under 100 persons were omitted from the analysis. Most of such meshes overlap with the green belt, athletic ground or area of water.
4) Shevky and Bell (1955) defined "occupation" as one of important attribute of "Social Rank (economic status)", and Berry and Tennant (1965), Rees (1968) and Murdie (1969) certified that "professional workers' ratio" was one of the most important attribute on "Socio-economic Status" dimension by factorial ecological analysis. By these initiative studies and many successive reports since then, the notion that "Professionals" is one of typical "sectorial" attribute is generally accepted.
5) Shevky and Bell (1955) defined "woman at work" as one of important attribute of "Urbanization (family status)", and Murdie (1969) certified that "% of females in the labor force" was one of the most important attributes on "Family Status" dimension by factorial ecological analysis. By these pioneer studies and many successive reports since then, the notion that "Working Woman" is one of typical "concentric" attribute is generally accepted.
6) Among the correlation coefficients between these three attributes, the maximum values amount to 0.809 in 1970 and 0.877 in 1985, and even the minimum values amount to 0.575 in 1970 and 0.703 in 1985. This indicates that there are close relationship between the three.
7) LQ are cariculated as follows:

$$\text{LQ (of each attribute in each city)} = \frac{\text{"\% in each zone"}}{\text{"\% in whole study area of each city"}}$$

8) To have more detailed understanding on the movement of high rise condominium's location in Sendai and Hiroshima, Takano (1988) and Yui (1986) are useful. Concerning the cities other than the four cities reported in the present paper, Kagawa (1990) on Nagoya and Kagawa (1988) on Osaka give useful information.

References

(*: in Japanese with English abstruct, **: in Japanese with French abstruct, ***: in Japanese without abstruct)

Berry, B.J.L. and R.J. Tennant (1965): *Commercial Structure*. North Illinois Planning Commission, in Berry and Horton (1970): *Geographic perspective on urban systems*. Prentice Hall, pp. 320～321.

Burgess, E.W. (1925): The growth of the city. in Park, Burgess and McKenzie: *The City*. Univ. of Chicago Press, 47～62.

Kagawa, T. (1990): Condominiums in Nagoya City and their locational characteristics. *Chirikagaku* (地理科学), **45**, 1～19.*

——— (1988): Changes within the surrounding area of CBD as affected by the construction of condominiums: a case study of Osaka City. *Geographical Review of Japan* (地理学評論), **61A**, 350～368.*

Ishimaru, T. (1986): Land Use Patterns in the Former Built-up Area of Hiroshima City, *Geographical Science* (地理科学), **44**, 99～111.*

Kuwajima, K. (1985): Geographical Distribution of Criminal Offenses in Sendai, Japan, *Ann, Tohoku Geogr, Assoc*, (東北地理), **37**, 125～130.

Murdie, R.A. (1969): The Factorial Ecology of Metropolitan Toronto 1951 and 1961. *Dept. of Geogr., Univ. of Chicago, Research Paper*, **116**, 88～89.

Rees, H. (1968): *The Factorial Ecology of Metropolitan Chicago*, (Master's thesis, Univ. of Chicago) in Berry and Horton (1970): *Geographic Perspective on Urban Systems*, Prentice Hall, 306～394 (chiefly 326～327).

Shevky, E. and W. Bell, (1955): *Social Area Analysis: Theory, illustrative application and computational procedures*. Stanford Univ. Press. in Theodorson (1961): *Studies in Human Ecology*, Harper & Row, 226～235.

Taira, A. (1990): La Transformation des Communautes et la Depopulation dans le Quartier de Kanda, Tokyo. *Geographical Review of Japan* (地理学評論), **63A**, 701～721.**

Takano, T. (1988): Emergence of the second peak of density around the CBD. *Sci. Repts. Tohoku Univ., Ser. 7*, **38**, 71～84.

Takayama, M. (1982): Inner City Housing Problems in the Osaka Metropolitan Region, *Jinbunchiri* (人文地理), **34**, 53～68.*

Tanaka, K. (1984): Spatial Pattern of Urban Crime Occurence and Urban Activities in Osaka City: static and time-serial analysis. *Jinbunchiri* (人文地理), **36**, 97～110.*

Yui, Y. (1986): Residential buildings in Hirosima City: their development and the characteristics of their residents. *Jinbunchiri* (人文地理), **38**, 56～77.*

成田孝三 (1976): 都心部周辺地帯の検証, 経済学雑誌, **74**-2, 1～32.***